utility. The more elementary drawings reproduce the laurel, snowdrop, tulip, and oak; the buttercup, poppy, and wild rose are considered suitable for a higher standard, and the blackberry, narcissus, and marguerite daisy are selected for the most difficult studies. The representations of the plants are botanically satisfactory, except the beech-fruits, that fail in colour and shape. In a few of the adapted designs, while making allowance for conventional treatment, there is unnecessary departure from the natural arrangement. For instance, the opposite insertion of the leaves in the privet is natural and characteristic, and should be maintained; similarly with regard to the pinnate leaves of the rose. It would have been useful to include in the explanatory booklet a short account of such botanical facts as the forms and insertion of leaves, the parts of a flower, their cyclic and acylic arrangements, and similar details. For the most part, however, the designs do maintain and emphasise the natural characteristics, thereby fulfilling the purpose of training students to derive their artistic conceptions direct from nature. The production of the charts is highly creditable, the drawings are bold, and the colour contrasts effective.

Problems in Surveying, Railroad Surveying, and Geodesy, with an Appendix on the Adjustments of the Engineer's Transit and Level. By Howard Chapin Ives and Harold Ezra Hilts. Pp. ix+136. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1906.) Price 6*s.* 6*d.* net.

WITH such a full title-page this book fairly well describes itself. The authors have been engaged in teaching engineering and surveying, and have found this graduated series of simple problems useful for sustaining the interest of their students in their work and for covering the course required by the faculty. The book is addressed to those who are professionally interested in such matters, or who wish to acquire the capacity to carry out certain operations in the field with facility, and with that amount of accuracy which the nature of the work demands. Consequently, there is little reference to theory. We have the ordinary methods of measuring by chain and problems connected with levelling. The compass, theodolite, and sextant come under review, and the mechanical adjustments of these instruments are described, but with no great minuteness. Greater care might have been bestowed on some of the formulæ given; those on p. 36 have apparently been misprinted. The railroad surveying problems are more satisfactory, and seem to be of practical utility.

A chapter on astronomical problems of a most elementary character has been added. In the preparation of this chapter the authors acknowledge the assistance they have received from a third authority. It must strike anyone with surprise that the authors should consider themselves competent to produce a book of this type, and yet feel it necessary to invite or to accept outside aid. W. E. P.

The Sense of Touch in Mammals and Birds, with Special Reference to the Papillary Ridges. By Dr. Walter Kidd. Pp. viii+176; illustrated. (London: A. and C. Black, 1907.) Price 5*s.* net.

HAVING in a companion volume treated of the direction of the hair in animals, Dr. Kidd, in the one now before us, turns his attention to the kindred subject of the structure and function of the papillary ridges on the tactile surface of their hands and feet. Although the subject is by no means new, the author has studied it in a fuller manner than at least most of his predecessors, and has a new theory with regard to the function of the ridges in the Primates, in which alone these structures attain full development. In monkeys, at any rate, it has been generally considered that the main purpose of the rough surface produced by the papillary ridges is to ensure firm hold in grasping. Without denying that this may be a part of their function, Dr. Kidd is, however, of opinion that there are other important uses, which vary in different groups. In man, for instance, the papillary ridges in the hand alone exercise the function of discriminative sensibility, and those in the foot that of maintaining the equilibrium of the body, whereas in the lower Primates both functions are discharged by the ridges of the two pairs of limbs, although sensibility is less marked in the front pair than in the human hand. The most interesting part of the author's conclusion relates, however, to the papillary ridges of lemurs, which are much more complicated than those of apes and man, and are accordingly believed to be subservient to the necessity for special means of preserving the equilibrium in the case of nocturnal creatures.

R. L.

Zur Wirtschafts- und Siedlungs-Geographie von Ober-Burma und den Nördlichen Shan-Staaten. By Dr. H. J. Wehrli. Pp. 130. (Zurich: Lohbauer, n.d.)

THOUGH in completeness and fulness of illustration this popular handbook of the British province of Burma bears, of course, no comparison with Sir J. G. Scott's recent monograph, it contains in a short space all that a merchant or a traveller intending to visit the country needs. The physical geography, climate, ethnology, natural productions, and industries are clearly described in a series of chapters illustrated by four maps and twelve photographic plates. The book is frankly a compilation from the best authorities, of which a full bibliography is appended. The maps, like all German work of the kind, are good, but the political map would be more useful if the boundaries were marked in colours. Except some of the handbooks for emigrants issued by our more important colonial Governments, we have no geographical series in English which corresponds with this. The organisation which has just been started to spread a knowledge of the Empire among British schoolboys might well provide a series of handbooks of this class.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE *No notice is taken of anonymous communications.*]

International Investigation of the Upper Air.

THE International Commission for Scientific Aëronautics has for some years past arranged that observations in the upper air by means of kites and balloons should be made on certain pre-arranged days, generally the first Thursday in each month. At the conference held at Milan in October last, M. Teisserenc de Bort suggested that better results would be obtained if a series of observations could be made on several successive days instead of on isolated days as hitherto.

It has accordingly been arranged that while the observations on the first Thursday in each month should be continued, some further days should be arranged for a more extended series of observations. The first of these series is to take place in the fourth week in July, and it is hoped that, besides the ordinary observatories that take part in the monthly ascents, as many meteorologists as possible should assist in order that observations may be obtained from a number of widely extended stations

The three principal days of the series are July 23, 24, and 25, but where possible ascents will also be made on July 22, 26, and 27. All the observatories engaged in upper-air research will take part. In addition, the Prince of Monaco will make observations in a high northern latitude, and a German man-of-war will send up *ballons-sondes* between Iceland and Norway. Another German expedition, under Captain Hildebrandt, will go to the neighbourhood of the Hebrides, while a French man-of-war will be stationed near the Azores. Further south, M. Teisserenc de Bort and Mr. Rotch will send an expedition, in their yacht *Otaria*, to the region of the trade winds and doldrums. It is hoped, also, that the Italian Government will cooperate by sending a man-of-war to some point in the Mediterranean. With the addition of Blue Hill Observatory and other North American stations, there will thus be a net-work of observations over a large region of the northern hemisphere.

In this country Mr. W. H. Dines will send up *ballons-sondes* and pilot balloons at a station on the west coast of Scotland; *ballons-sondes* and pilot balloons will also be sent up at Manchester by Mr. Petavel, and at Ditcham Park, Petersfield. Conditions in this country at the end of July are not likely to be favourable for flying kites, but should there be sufficient wind kites will be flown at Glossop Moor, Pyrton Hill, Ditcham Park, and Brighton.

The Royal Meteorological Society is also making arrangements to cooperate in the investigations, and an allowance (in aid of the expenses) has been made to them from the Government grant for scientific investigations.

It may be possible to obtain the assistance of other observers to send up pilot balloons; by the use of two theodolites and a measured base, the velocity and direction of the wind and the heights of clouds may be determined. By using rubber balloons and filling them to a certain size corresponding to a known rate of ascent, useful observations may be made by a single observer using an ordinary theodolite.

The International Commission has also arranged for a series of observations on September 4, 5, and 6, and on November 6, 7, and 8.

CHARLES J. P. CAVE.

Radium and Geology.

THE temperature of 55° C. to which I referred in a former letter is the temperature of the *rock*. I find that Prof. C. Schmidt, of Basel, on his chart of isogeotherms, gives this temperature as attaining 56° C. This is in the dry part of the tunnel, towards the north end.

The difficulty attending the inflow of warm water mainly arose from the *rate* at which heat was thereby brought into the tunnel, necessitating large supplies of cold water to keep down the temperature. Prof. Schardt's paper, to which I have already referred, contains very strong evidence as to the *rôle* of the circulating water. The evidence is far too lengthy to quote here.

Mr. Fisher refers to the Hon. R. J. Strutt's estimates of radium in rocks as capable of accounting for a gradient of 1° F. in 42·4 feet. In point of fact, Mr. Strutt *assumes* this gradient (quoting from Prestwich) as a basis upon which to calculate the thickness of the radium-bearing crust. The gradient in question is, therefore, not derived from Mr. Strutt's observations (nor could it be), but is a gradient taken as a basis of calculation.

That special conditions affect the temperature gradients in mountain ranges appears from the results of observations on the Mont Cenis and the St. Gothard tunnels. Everett's estimate for the former, with correction for convexity of surface, is 1° F. in 79 feet. In the case of the latter there were remarkable variations observed, of which radium will very probably furnish the explanation. The central gradient is 1° F. in 85 feet. At the north end there is a gradient of 1° F. in 38 feet. This brings the general average for the whole tunnel up to 1° F. in 57·8 feet. Dr. Stapff, who conducted the temperature observations in the St. Gothard, subsequently predicted for the Simplon a maximum rock temperature of 47° C., as I have already pointed out.

J. JOLY.

Trinity College, Dublin.

AËRIAL LOCOMOTION.

IN December of last year Dr. Alexander Graham Bell delivered an address, under the above title, before the Washington Academy of Sciences. This address recently appeared in the March number of the Proceedings of that academy[1] (vol. viii., pp. 407–448), and the interesting nature of the contents is well worth the attention of the readers of this Journal who have not had the opportunity of perusing it.

In the opening paragraphs Dr. Bell refers to the earlier attempts made to travel in the air, and points out how the problem in the last decade or so has gradually been approached from a different point of view. The principle of the gas bag has taken second place, and the heavier-than-air type of machine is now in the forefront.

The researches of Lilienthal are next referred to, followed by those of Chanute, Herring, the Brothers Wright, and Hargrave. The magnificent work accomplished by Langley is here given its proper position. "To Prof. Langley," as Dr. Bell remarks, "is due the chief credit of placing this subject upon a proper basis, and of practically originating what he termed the art of 'Aerodromics.'"

Dr. Bell witnessed the experiments made by

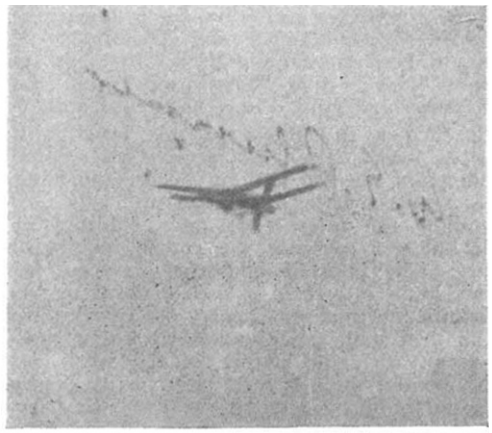

FIG. 1.—Langley's Aërodrome No. 5 in Flight, May 6, 1896.

Langley on May 6, 1896, when a large model of an aërodrome, with a spread of wing of about 14 feet, was driven through the air by a steam engine under the action of its own propellers. With regard to the actual flight he saw, he wrote:—"No one who witnessed the extraordinary spectacle of a steam engine flying with wings in the air, like a great soaring bird, could doubt for one moment the practicability of mechanical flight." Dr. Bell was fortunate enough to secure a photograph of the apparatus while in the air, and this record, which is reproduced in his article, is here given (Fig. 1). In time it will undoubtedly be of exceptional historical interest.

The circumstances connected with the later experiments of Langley are next described, and Dr. Bell's knowledge and great faith in Langley's work allow him to state his unbiased opinion that the full-sized aërodrome, which the newspapers described as a failure, "would have flown had it been safely launched into the air."

It is with regret, however, that we find no mention made of either Hiram Maxim or Pilcher, for the

[1] See also *The National Geographic Magazine*, vol. xviii., No. 1, January.